

# Memorandum



Date: May 1, 2018

To: City of Wichita

From: Burns & McDonnell

Subject: Northwest Water Treatment Facility: Water Distribution System

## **SECTION 1 INTRODUCTION**

The City of Wichita currently operates a Main Water Treatment Plant (MWTP) located in the Sim Park area. This treatment facility operates as a Central Plant with a capacity of 130 million gallons per day (MGD) and an East Plant with a capacity of 30 MGD. The current plant is serviced by Hess High Service Pump Station (HSPS). The existing distribution branches out from Hess HSPS to multiple 48" lines branching out throughout the City.

The City has requested that distribution alternatives be evaluated to connect the new 120 MGD Northwest Water Treatment Facility (NWWTF) into the existing water distribution system. The new system will be required to convey the full 140 MGD (total capacity) produced by the new plant plus peak hourly flow into the distribution system.

This technical memorandum provides a summary of alternative distribution options, pros and cons of each option and final selected option.

## **SECTION 2 ALTERNATIVES**

There are many options available to integrate the new NWWTF into the existing water distribution network. The current distribution system is centered on a single HSPS which is centrally located near the MWTP. Several 48" water mains branch out from this central location and feed outward to the extents of the city. The new NWWTF location is northwest of this existing central distribution system. This requires that the new treated water be connected to the main lines located close to the existing center of the water network or that water enter the distribution system at other locations capable of conveying adequate amounts of water. This will ensure the water distribution system will continue to operate as it is currently designed.

The new NWWTF and each pipeline option was implemented into the current hydraulic model that was calibrated in 2016. The model was used to size the pipeline options and confirm that the existing distribution system hydraulics can be maintained. The current and primary control point for pressure in the entire distribution system is approximately 90-92 psi at the intersection of Central and Main. Since the distribution system includes minimal elevated storage, maintaining pressure set points is of primary importance in the operation of the distribution

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system. Peripheral pressure zones also have pressure set points that booster pump stations use for system control. In each of the pipeline options evaluated with the hydraulic model, the pressure control point at the intersection of Central and Main has been adhered to.

Several options were discussed and broken down to four main potential alternatives for the connection to the existing distribution system. These options are outlined below.

## 2.1 Single Low Service Pipeline to existing Hess Pump Station

This option utilizes the existing distribution system infrastructure to its maximum potential by using the existing Hess Pump Station to distribute the new finished water through the system, exactly as the current operation does. A new 72" water main will be required to convey the required flow generated by the new NWWTF. A new low service pump station (LSPS) would be required at the NWWTF to accomplish the water conveyance. However, this option would make use of existing finished water storage near Hess Pump Station, which reduces the need for additional storage at the NWWTF. The proposed alignment is shown in the figure below.

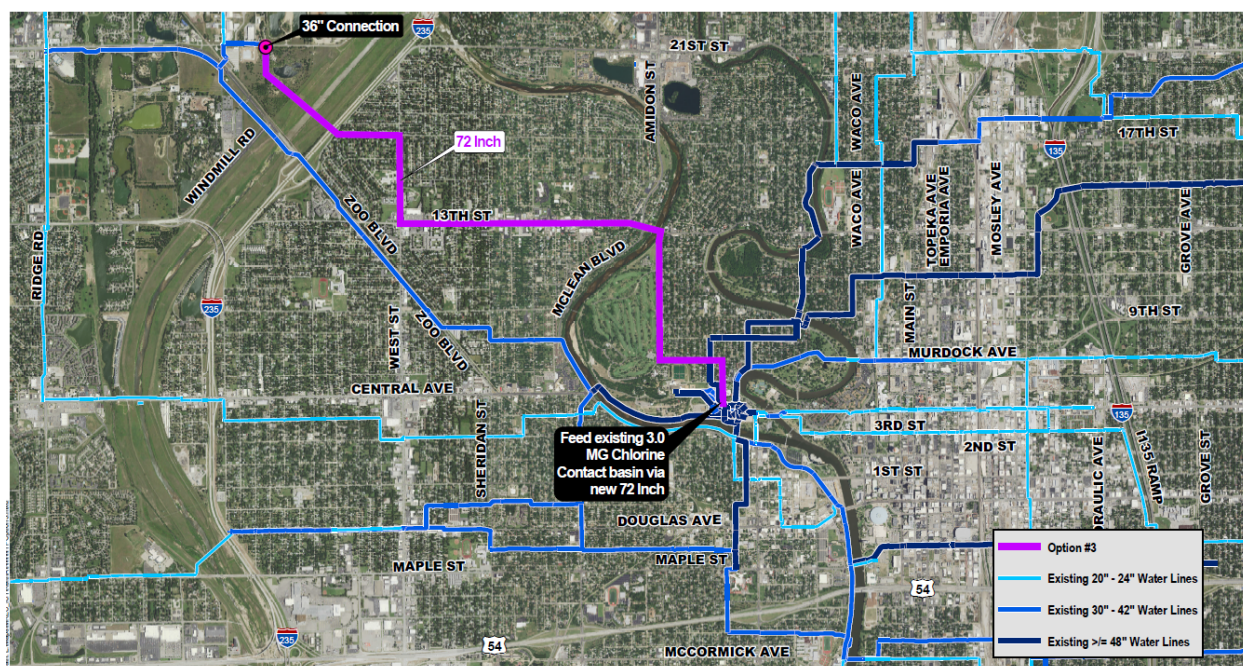


Figure 1 – Single Low Service Pipeline to Hess Pump Station

Initial review of this option outlined both benefits and challenges. The key points can be summarized as follows:

- Lower pumping costs at new facility, lowest capital cost, single route reduces ROW, land acquisition, etc.



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- Single route is a single point of failure for full flow. Failure disrupts water supply to all customers.
- No new high service pump station. Still reliant on older Hess Pump Station.

## 2.2 Single High Service Pipeline Directly to Distribution

This option provides a new HSPS as part of the new NWWTF along with one new water main line to connect directly into the existing distribution system. A connection would be made near the NWWTF to send water to the northwest portions of the City and the new water main would distribute water to the remainder of the City. The new HSPS would remove the reliance on the existing Hess Pump Station completely and be capable of delivering the full 140 MGD plus peak hourly flow directly to the distribution system. The new 84" water main would be connected to the existing distribution system at a minimum of five locations to ensure proper volume and pressure throughout existing distribution system. The proposed alignment and key connection points are shown in the figure below.

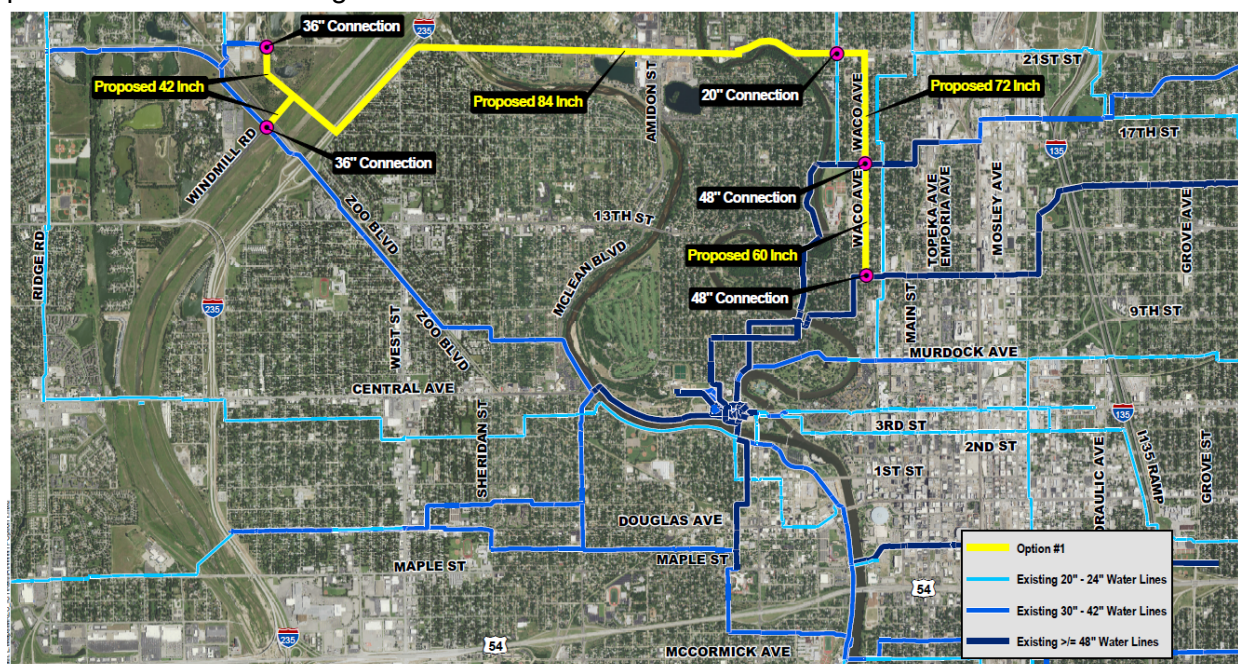


Figure 2 – Single High Service Pipeline Directly to Distribution

Initial review of this option outlined both benefits and challenges. The key points can be summarized as follows:

- New HSPS reduces reliance on older infrastructure. Single route reduces ROW, land acquisition, etc.
- Single route is a single point of failure for approximately 2/3 of the City.

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- 84" is the largest pipe to construct of any option.
- Increased pressures in downtown area could result in more breakages.

### 2.3 Two High Service Pipelines Directly to Distribution

This option provides a new HSPS as part of the new NWWTF along with two new water main lines to connect directly into the existing distribution system along two separate routes. The new HSPS would remove the reliance on the existing Hess Pump Station completely and be capable of delivering the full 140 MGD plus peak hourly flow to the system. The two new water mains would be connected to the existing distribution system at a minimum of 14 locations to ensure proper volume and pressure throughout the existing distribution system. The two separate alignments provides a minimal level of redundancy as well as a more controllable pressure throughout the existing system. The proposed alignment and key connection points are shown in the figure below.

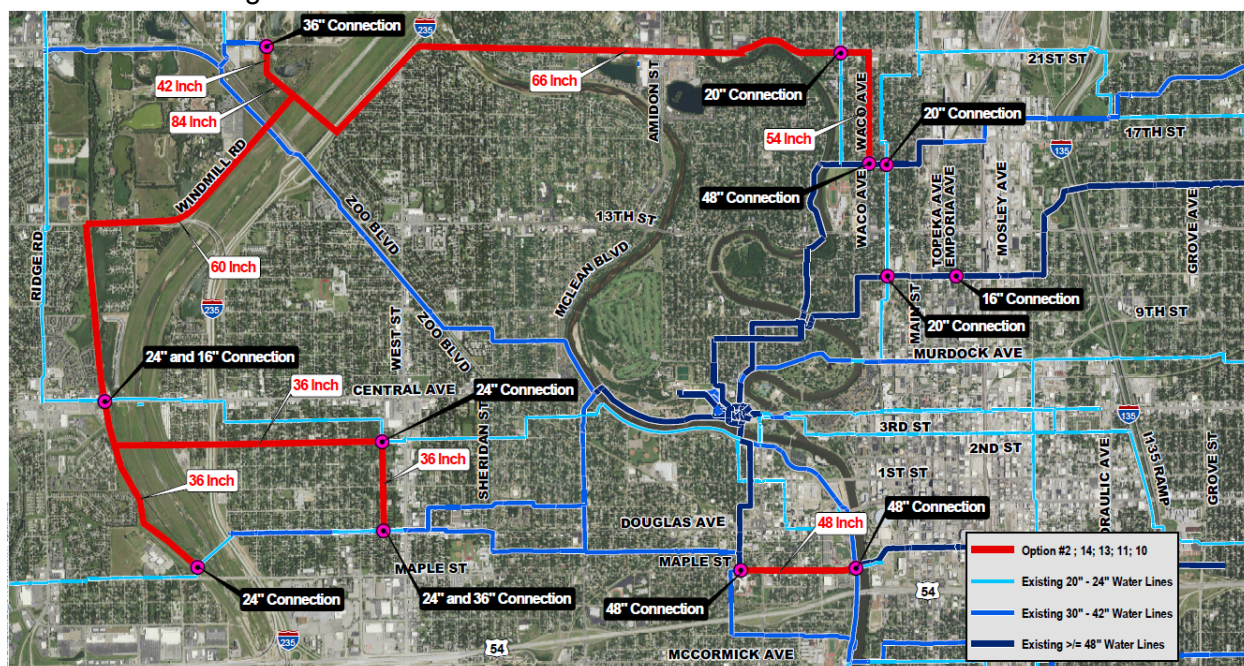


Figure 3 – Two High Service Pipelines Directly to Distribution

Initial review of this option outlined both benefits and challenges. The key points can be summarized as follows:

- New HSPS reduces reliance on older infrastructure.
- Partial redundancy with two lines.
- Smaller lines are more manageable, easier to construct, and easier to repair.
- Controls downtown pressures.
- Dual alignments increase ROW, land acquisition, etc. Two levee crossings.



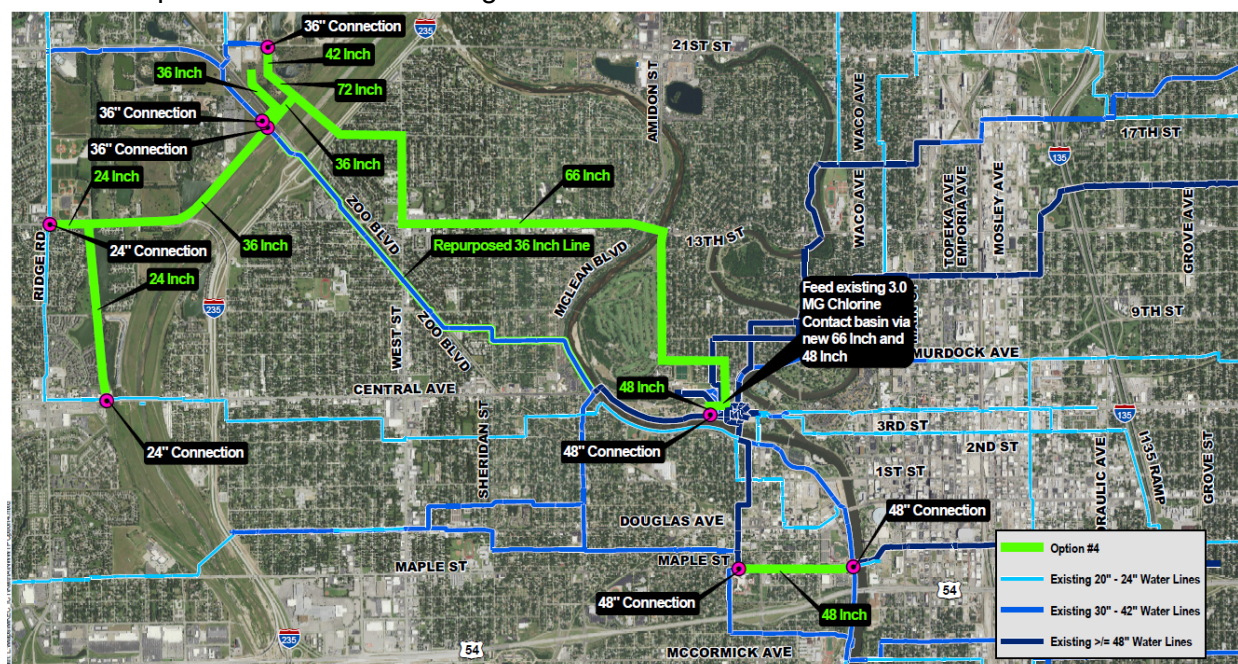
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- High capital cost with two large diameter pipelines.

## 2.4 Low Service to Hess, New High Service to West Pressure Zone.

This option provides a new High Service and Low Service Pump Station as part of the new NWWTF. The low service side would feed a new 66" water main as well as an existing 36" water main to feed the existing Hess pump station. Hess would provide high service to the existing distribution system except for the northwest portion of the City. The new HSPS would provide a new pressure zone for the western section of the existing distribution system. This option balances the use of new and existing infrastructure. The proposed alignment and key connection points are shown in the figure below.



**Figure 4 – Low Service to Hess, New High Service to West Pressure Zone**

Initial review of this option outlined both benefits and challenges. The key points can be summarized as follows:

- Lower pumping costs at new facility.
- Partial redundancy with two lines to Hess.
- Smaller lines are more manageable, easier to construct, and easier to repair.
- Controls downtown pressures. New high service to West Pressure Zone.
- Approximately 2/3 of the City still reliant on older Hess Pump Station.
- Dual piping to Hess is not completely redundant.
- Dual alignments increase ROW, land acquisition, etc.

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**SECTION 3      SELECTED ALTERNATIVE**

As discussed in section 2.1 of this memorandum, a new single low service water line from the new NWWTF to the existing Hess pump station was selected as the most cost-effective approach to connect the new facility into the water distribution system. The use of a low service water line allows for cost savings and reduction in power requirements at the new facility.

Several alignments were reviewed with the City to determine the most cost-effective and efficient path for the new 72" line. The final alignment best incorporates into the Capital Improvement Program as well as limits the disruption to residential communities. The new line does not require any additional connections to the current distribution system and only needs to connect at the finished water storage tanks at the MWTP upstream of Hess pump station.

The Low Service Pump Station will deliver finished water to storage near Hess Pump Station. The Low Service Pump Station will have the capability to pump any flow rate from 30 MGD to 150 MGD to meet peak day demand, while Hess will still be responsible for providing peak hourly flows. The 10 MGD pumps include variable frequency drives to allow flow increments less than 10 MGD.

**Table 1 – Low Service Pump Station Design Basis**

Design Head		25 ft (10.8 psi)
Pump Efficiency		80%
Motor Efficiency		96%
<b>Quantity</b>	<b>Capacity (MGD)</b>	<b>BHP (ea)</b>
2	10	57
2	20	114
3	30	171
Total Connected Capacity	150 MGD	856
Firm Capacity	120 MGD	685